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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

MULL, FRED H

ART UNIT	PAPER NUMBER
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3662

DATE MAILED: 03/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/056,434

Applicant(s)

ALEXANDER, WILLIAM FRANCIS

Examiner

Fred H. Mull

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 April 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION***Specification***

1. The disclosure is objected to because of the following informalities: Subscripts and superscripts should be used, where conventional, for scientific equations. For example, on p. 6, line 9, " $a(\theta)=[a_1(\theta) a_2(\theta) \dots a_N(\theta)]^T$ " should read -- $a(\theta) = [a_1(\theta) \ a_2(\theta) \ \dots \ a_N(\theta)]^T$ --. For another example, on p. 13, line 13, " $(|r_{i1}|/|r_{i2}|)$ " should read -- $|r_{i,1}|^2 / |r_{i,2}|^2$ --.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. Claims 1-26 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

It is unclear to the examiner exactly what is being disclosed in the specification. The following is how the examiner interprets the specification. On p. 6, equation 2 provides previously measured directivities for the antennas in the array configuration. On p. 13, the magnitudes of each signal at each antenna are measured, and then the "amplitude difference", which is really a division, is calculated. On p. 14, this is then corrected for the antenna directivities to give a rough, but unambiguous, first DOA. Then a phase difference is calculated which gives several DOAs, due to ambiguities caused by the antenna elements being spaced at greater than one-half of the wavelength of the signal, the correct DOA being more accurate than

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first DOA. The ambiguous DOA that is closest to the first DOA is chosen to be the correct DOA of the receiver being tracked. If this is incorrect, applicant is required to provide a clear, concise summary of what is actually going on. All the use of terms like "calibration computer" and "calibrated phase difference 136" are confusing, since it would seem like the determination of the directivities on p. 6 would be the calibration step, and what is occurring on p. 13-16 is simply the DOA measurement procedure. Correcting for the directivities could be considered applying the calibration. The terminology is just confusing.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over IDS Document Bruckert (US 5,786,791 A) in view of Murphy.

In regard to claims 1, 8-15, and 20-26, Bruckert discloses a first antenna (105, Fig. 1) and a second antenna (107) configured to receive an RF signal from the remote unit (115), said RF signal including a plurality of scattered rays produced by multipath scattering (Fig. 4); a ray selector configured to identify a first ray from said scattered plurality of rays received at said first antenna and a second ray from said plurality of scattered rays received at said second antenna; a difference calculator configured to determine an amplitude difference between said first and

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second ray; and an angle estimator configured to calculate a DOA based on said amplitude difference (column 2, line 30 to column 3, line 27).

Bruckert further discloses that the DOA can be used to determine remote unit location (column 2, lines 62-64).

Bruckert fails to disclose a difference calculator configured to determine a phase difference between said first ray and said second ray and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference.

Murphy discloses a first antenna and a second antenna configured to receive an RF signal from the remote unit; a difference calculator configured to determine an amplitude difference and a phase difference between said first and second ray; and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference and select one of said plurality of DOA values utilizing said amplitude difference (column 2, lines 52-63).

Murphy further discloses that the amplitude difference method alone is much less accurate (column 1, lines 59-61) than the combined amplitude difference/phase difference method (column 2, lines 62-63).

The remote unit location system of Bruckert provides a relatively inaccurate location due to relatively inaccurate DOAs. However, the FCC's regulations for wireless emergency 911 phone calls is relatively stringent, and DOAs on the order of 20 degrees will not meet the required location accuracy. It would have been obvious to include phase difference determination in addition to amplitude difference determination, as taught by Murphy, into the system of Bruckert in order to be able the determination of much more accurate DOAs and therefore much more accurate remote unit locations for 911 calls in multipath environments.

In regard to claims 2 and 16, Murphy further discloses a separation distance between said first antenna and said second antenna is greater than one-half of the wavelength of said RF signal (column 5, lines 22-27), where it is well known that the spacing between antenna phase centers that will result in direction ambiguities is greater than one-half a wavelength of the received RF signals.

In regard to claim 3, Bruckert further discloses a third (103, Fig. 1) and fourth (113) antenna configured to receive said RF signal including said plurality of scattered rays produced by multipath scattering.

In regard to claim 4, Bruckert further discloses being able to determine DOAs based on amplitude difference with multiple pairs of antennas representing multiple cell sectors (101; column 3, lines 48-67). It would be obvious to include phase differences to increase DOA accuracy in all sectors.

In regard to claims 5 and 17, Bruckert further discloses the communication system is a CDMA communications system (column 3, lines 30-35).

In regard to claims 6 and 18, Bruckert further discloses said RF signal is an encoded spread-spectrum digital signal having a multiplicity of frequency and time overlapping coded signals from the remote unit and a plurality of remote units other than remote units (column 4, lines 1-37).

In regard to claims 7 and 19, Bruckert further discloses said first ray and said second ray are prompt rays (column 2, lines 35-46).

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4. Claims 2 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over IDS Document Bruckert (US 5,786,791 A) and Murphy in further view of Chasek.

Murphy further discloses a separation distance between said first antenna and said second antenna is greater than one-half of the wavelength of said RF signal (column 5, lines 22-27), where Chasek discloses that the spacing between antenna phase centers that will result in direction ambiguities is greater than one-half a wavelength of the received RF signals (column 2, lines 47-59).

5. Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over IDS Document Bruckert (US 5,786,791 A), Schaefer, and Murphy.

In regard to claims 1, 8-15, and 20-26, Bruckert discloses a first antenna (105, Fig. 1) and a second antenna (107) configured to receive an RF signal from the remote unit (115), said RF signal including a plurality of scattered rays produced by multipath scattering (Fig. 4); a ray selector configured to identify a first ray from said scattered plurality of rays received at said first antenna and a second ray from said plurality of scattered rays received at said second antenna; a difference calculator configured to determine an amplitude difference between said first and second ray; and an angle estimator configured to calculate a DOA based on said amplitude difference (column 2, line 30 to column 3, line 27).

Bruckert further discloses that the DOA can be used to determine remote unit location (column 2, lines 62-64).

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Bruckert fails to disclose a difference calculator configured to determine a phase difference between said first ray and said second ray and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference.

Schaefer discloses a first antenna (10) and a second antenna (12) configured to receive an RF signal from the remote unit; a difference calculator configured to determine an amplitude difference and a phase difference between said first and second ray; and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference and select one of said plurality of DOA values utilizing said amplitude difference (column 2, lines 19-37; column 3, lines 23-56).

Murphy discloses that the amplitude difference method alone is much less accurate (column 1, lines 59-61) than the combined amplitude difference/phase difference method (column 2, lines 62-63).

The remote unit location system of Bruckert provides a relatively inaccurate location due to relatively inaccurate DOAs. However, the FCC's regulations for wireless emergency 911 phone calls is relatively stringent, and DOAs on the order of 20 degrees will not meet the required location accuracy. It would have been obvious to include phase difference determination in addition to amplitude difference determination, as taught by Schaefer, into the system of Bruckert in order to be able the determination of much more accurate DOAs, as taught by Murphy, and therefore much more accurate remote unit locations for 911 calls in multipath environments.

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In regard to claims 2 and 16, Schaefer further discloses a separation distance between said first antenna and said second antenna is greater than one-half of the wavelength of said RF signal (column 1, lines 52-54; column 3, lines 23-28).

In regard to claim 3, Bruckert further discloses a third (103, Fig. 1) and fourth (113) antenna configured to receive said RF signal including said plurality of scattered rays produced by multipath scattering.

In regard to claim 4, Bruckert further discloses being able to determine DOAs based on amplitude difference with multiple pairs of antennas representing multiple cell sectors (101; column 3, lines 48-67). It would be obvious to include phase differences to increase DOA accuracy in all sectors.

In regard to claims 5 and 17, Bruckert further discloses the communication system is a CDMA communications system (column 3, lines 30-35).

In regard to claims 6 and 18, Bruckert further discloses said RF signal is an encoded spread-spectrum digital signal having a multiplicity of frequency and time overlapping coded signals from the remote unit and a plurality of remove units other than remote units (column 4, lines 1-37).

In regard to claims 7 and 19, Bruckert further discloses said first ray and said second ray are prompt rays (column 2, lines 35-46).

6. Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over IDS Document Bruckert (US 5,786,791 A), Chasek, and Murphy.

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In regard to claims 1, 8-15, and 20-26, Bruckert discloses a first antenna (105, Fig. 1) and a second antenna (107) configured to receive an RF signal from the remote unit (115), said RF signal including a plurality of scattered rays produced by multipath scattering (Fig. 4); a ray selector configured to identify a first ray from said scattered plurality of rays received at said first antenna and a second ray from said plurality of scattered rays received at said second antenna; a difference calculator configured to determine an amplitude difference between said first and second ray; and an angle estimator configured to calculate a DOA based on said amplitude difference (column 2, line 30 to column 3, line 27).

Bruckert further discloses that the DOA can be used to determine remote unit location (column 2, lines 62-64).

Bruckert fails to disclose a difference calculator configured to determine a phase difference between said first ray and said second ray and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference.

Chasek discloses a first antenna and a second antenna configured to receive an RF signal from the remote unit; a difference calculator configured to determine an amplitude difference and a phase difference between said first and second ray; and an angle estimator configured to calculate a plurality of DOA values based at least in part upon said phase difference and select one of said plurality of DOA values utilizing said amplitude difference (column 2, lines 46-59).

Murphy discloses that the amplitude difference method alone is much less accurate (column 1, lines 59-61) than the combined amplitude difference/phase difference method (column 2, lines 62-63).

The remote unit location system of Bruckert provides a relatively inaccurate location due to relatively inaccurate DOAs. However, the FCC's regulations for wireless emergency 911 phone calls is relatively stringent, and DOAs on the order of 20 degrees will not meet the required location accuracy. It would have been obvious to include phase difference determination in addition to amplitude difference determination, as taught by Schaefer, into the system of Bruckert in order to be enable the determination of much more accurate DOAs, as taught by Murphy, and therefore much more accurate remote unit locations for 911 calls in multipath environments.

In regard to claims 2 and 16, Chasek further discloses a separation distance between said first antenna and said second antenna is greater than one-half of the wavelength of said RF signal (column 2, lines 47-59).

In regard to claim 3, Bruckert further discloses a third (103, Fig. 1) and fourth (113) antenna configured to receive said RF signal including said plurality of scattered rays produced by multipath scattering.

In regard to claim 4, Bruckert further discloses being able to determine DOAs based on amplitude difference with multiple pairs of antennas representing multiple cell sectors (101; column 3, lines 48-67). It would be obvious to include phase differences to increase DOA accuracy in all sectors.

In regard to claims 5 and 17, Bruckert further discloses the communication system is a CDMA communications system (column 3, lines 30-35).

In regard to claims 6 and 18, Bruckert further discloses said RF signal is an encoded spread-spectrum digital signal having a multiplicity of frequency and time overlapping coded

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signals from the remote unit and a plurality of remove units other than remote units (column 4, lines 1-37).

In regard to claims 7 and 19, Bruckert further discloses said first ray and said second ray are prompt rays (column 2, lines 35-46).

7. The examiner also finds the following reference(s) relevant:

IDS Document Nossen (US 4,833,478 A), who discloses using relative amplitude in selecting from ambiguous DOAs.

Wong, Amin, and Azzarelli, who disclose using more complicated methods of resolving DOA ambiguities in antenna arrays with inter-element spacings greater than one-half of the signal wavelength.

Applicant is encouraged to consider these documents in formulating their response (if one is required) to this action, in order to expedite prosecution of this application.

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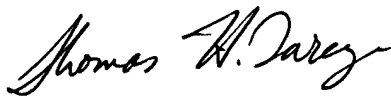
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred H. Mull whose telephone number is 703-305-1250. The examiner can normally be reached on M-F 9:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas H. Tarcza can be reached on 703-360-4171. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9326 for regular communications and 703-872-9327 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

Fred H. Mull
Examiner
Art Unit 3662

FHM
March 13, 2003


THOMAS H. TARCZA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600